paratively free from nuclei. In the vicintiy of the dividing line the lymphatics were widely dilated. No mast cells of the type described by Unna[7] as occurring in neurofibromas[8] were found. Histologically the tumor was almost a duplicate of the one examined by Goth[9].

CONCLUSION. The lesions of fibroma molluscum gravidarum are histologically identical with those of fibroma molluscum (the neurofibromas of v. Recklinghausen). As Pusey[10] has suggested, this group of cases demonstrates the possibility of production of fibromata by systemic causes, but as to the nature of these causes we are hardly in position even to surmise.

THE METABOLISM, PREVENTION, AND SUCCESSFUL TREATMENT OF RHEUMATOID ARTHRITIS: SECOND CONTRIBUTION.

By RALPH PEMBERTON, M.S., M.D.,

PHYSICIAN TO THE HOSPITAL AND DIRECTOR OF THE DEPARTMENT OF CLINICAL CHEMISTRY IN THE PATHOLOGICAL LABORATORY, PRESBYTERIAN HOSPITAL, PHILADELPHIA.

(Concluded from February, 1914.)

TESTS OF KIDNEY ELIMINATION BY MEANS OF PHENOL-SULPHONEPHTHALEIN.

The tests below were conducted according to the accepted technique of Rowntree and Gerarghty, and need no description here.

CASE VII.—December 22, 1912. First appearance of the drug in four and a half minutes.

At the end of the first hour the elimination was	53.07 per cent.
At the end of the second hour the elimination was	13.72 "
Total elimination was	66.79 "

CASE VIII.—First appearance of the drug in nine minutes.

EXPERIMENT 1.

At the end of the first hour the elimination was	45.00 per cent.
At the end of the second hour it was too dilute to be read	

First appearance of the drug in five minutes.

---

[7] Histopathology of the Diseases of the Skin, Walker's translation, New York, 1896, p. 847.

[8] See v. Recklinghausen, Ueber die multiplen Fibrome der Haut, und ihre beziehung zu dem multiplen Neuromen, Berlin, 1882.

[9] Loc. cit.

[10] Principles and Practice of Dermatology, New York, 1911, p. 863.

Experiment 2.

At the end of the first hour the elimination was	40.32	per cent.
At the end of the second hour the elimination was	15.00	"
Total elimination was	55.32	"

Case IX.—First appearance of the drug in ten minutes.

At the end of the first hour the elimination was	37.40	per cent.
At the end of the second hour the elimination was	23.80	"
Total elimination was	61.20	"

Case XI.—First appearance of the drug in seven minutes.

Experiment 1, March 25, 1913.

At the end of the first hour the elimination was	31.25	per cent.
At the end of the second hour the elimination was	13.22	"
Total elimination was	44.47	"

First appearance of the drug in eight minutes.

Experiment 2, March 27, 1913.

At the end of the first hour the elimination was	33.50	per cent.
At the end of the second hour the elimination was	11.80	"
Total elimination was	45.30	"

Case XIII.—First appearance of the drug in eleven minutes.

Experiment 1.

At the end of the first hour the elimination was	36.10	per cent.
At the end of the second hour the elimination was	10.20	"
Total elimination was	46.30	"

First appearance of the drug in eight minutes.

Experiment 2, April 19, 1913.

At the end of the first hour the elimination was	43.00	per cent.
At the end of the second hour the elimination was	7.30	"
Total elimination was	50.30	"

Case XIX.—Referred by Dr. F. H. Klaer. This patient's condition was far advanced and he was definitely crippled. The disease was of many years' standing. He was not treated, as he refused to be put on a diet, and left the hospital. It is interesting to note that in the search for foci of infection, this man had had his tonsils and adenoids removed and so many carious teeth pulled that he could eat only liquid and semiliquid diet. No relief followed. Unfortunately, the actual figures of kidney elimination were mislaid, but they were entirely normal on two separate occasions.

CASE XII.—First appearance of the drug in seven minutes.

At the end of the first hour the elimination was	53.00	per cent.
At the end of the second hour the elimination was	9.40	"
Total elimination was	62.40	"

A consideration of the above elimination figures shows that a patient with well-advanced rheumatoid arthritis may have normal elimination and that in no case tested was it distinctly low.

Case XI presented about 32 per cent. elimination at the end of the first hour, but this was no great departure from the normal for her age, which was forty-seven years.

ANAPHYLACTIC EXPERIMENTS.—The joint pains and certain other analogies between rheumatoid arthritis and occasional symptoms of anaphylaxis suggested the possibility that rheumatoid arthritis might be caused by some such mechanism, and experiments along this line were undertaken.

In view also of the demonstrable relation to the disease of proteids and carbohydrates, there was suggested the possibility of the passage through the bowel, in insufficiently altered state, of some of the elements of the proteid molecule of either animal or vegetable source.

If demonstrated the deleterious action of some of the carbohydrate foods, such as rice and potato, could be explained in part on this basis, as some workers have shown that animals can be sensitized to vegetable proteid by being fed therewith.

As a starting point, Case VII, Case VIII, Case XI, and Case XIII were respectively fed two to three soft-cooked eggs (not boiled) on an empty stomach. Two hours later about 200 c.c. blood were withdrawn from a vein of the arm under aseptic precautions and whipped. The resulting supernatent fluid was centrifuged until fairly clear and then injected in various amounts from 2 to 5 c.c. into the peritoneal cavities of guinea-pigs. In the case of Case XI the blood was withdrawn twenty-four hours after ingestion of the eggs.

At a period more than three weeks later these pigs were injected with varying amounts, from 2 to 5 c.c. of a 25 per cent. solution of egg albumen into the jugular vein or (twice) into the peritoneal cavity.

In the presence of heterologous proteid in the circulating blood of the patients fed upon uncooked eggs the guinea-pigs should have become sensitized to this, and should have shown this sensitization by anaphylaxis when injected with egg albumen. No clear anaphylactic phenomena could be detected, however, in any of the pigs.

Thinking that faulty technique on the writer's part, in giving the anaphylactic injections might be responsible for some of the first negative results, the experiments were continued with the help of Dr. Richard M. Pearce,[1] to whom obligation is due for this and other courtesies. The results of these experiments were also negative, however.

March 10, 1913. 2 P. M. Case VII was given two soft-cooked eggs. Blood was withdrawn from the left arm at 4 P.M. After whipping and centrifuging, 2 c.c. were injected into one pig and 3.5 c.c. into another. Both these pigs were tested, with the help of Dr. Pearce, on April 8, each getting from 3.5 c.c. to 5 c.c. egg albumen solution, with negative results, as above noted.

March 11, The same experiment was performed on Case VIII, who received three raw eggs at 2 P.M. Blood was withdrawn at 4.30 P.M., and 2 c.c. were injected into the abdominal cavities of each of three pigs. One pig died April 2.

April 3. The remaining two pigs were injected intraperitoneally with 5 and 10 c.c. of 25 per cent. egg albumen solution, with no obvious anaphylactic result, one dying thirty-six hours later. The other was tested again by Dr. Pearce on April 8, as above noted, with no result.

March 30. Case XI. Blood was withdrawn at 8 A.M. and injected into three pigs, as above described, in amounts of 3 c.c. in two pigs, and 2 c.c. in one pig. Patient had had no breakfast, and had been fed one egg twenty-four hours previously. The primary purpose of obtaining blood was for determinations of the urea and non-coagulable nitrogen content. Advantage was taken of this opportunity, however, to include experiments by means of anaphylaxis at a longer period after ingestion of egg albumen.

April 19. The above three pigs were tested with 5 c.c. of 25 per cent. egg albumen in salt solution, with entirely negative results.

May 28. At 1 P.M. Case XIII This patient was fed three soft-cooked but unboiled eggs on an empty stomach, having had no other lunch. At 4 P.M. blood was withdrawn and treated as usual. Pigs 1, 2, and 3 were sensitized intraperitoneally with 5.5, 3.5, and 5 c.c. of blood respectively. Pig 1 showed weakness of the hind legs, malaise, and diarrhea, and died in thirty-six hours. The other two were essentially inaffected by the sensitizing injections.

June 19. The two remaining pigs were injected in the jugular with 5 c.c. of 25 per cent. egg albumen salt solution. Pig 3, which had had 5 c.c. of blood as a sensitizing dose, showed no anaphylactic symptoms. Pig 2, however, which had had 3.5 c.c. of blood, showed symptoms suggestive of anaphylaxis. It kicked violently with the left hind foot, continuing this in the form of scratching movements for a few moments, and then showed great collapse. It recovered from this pretty well after five minutes, and in twenty minutes appeared nearly normal. This was the sole instance in which anything approaching true anaphylaxis was observed. The evidence from these experiments is therefore negative, and while in apparent harmony with the negative results of the blood analyses and certain other data, it must be more extended before positive conclusions can be drawn on this point. It is to be noted that the pig showing evidences of anaphylaxis was sensitized with blood drawn later after ingestion of eggs by the patient (three hours) than in the other cases. The too early withdrawal of blood may have been the source of failure here, and is to be considered in future work. It must be confessed, however that these generally negative, results and the manifestly harmful role played in this disease by pure carbohydrate render this line of investigation of doubtful promise in this particular regard.

---

[1] The technique used is set forth by Richard M. Pearce, M.D., in the Retention of Foreign Proteid by the Kidney, Jour. Exper. Med., 1912, xvi, No. 3.

ANALYSES OF THE UREA AND NON-COAGULABLE NITROGEN IN THE CIRCULATING BLOOD.—There have recently been devised methods which allow of the accurate analysis of small amounts of blood for such substances as urea, uric acid, and the non-coagulable nitrogen.[2]

Folin and Denis have shown that in renal disease there are marked departures from health, the total non-coagulable nitrogen rising above the normal of about 25 mg. per 100 c.c. of blood to as high as several times that amount or even in some cases to 180 mg. per 100 c.c.

The applicability of these methods to the study of such problems as the present is obvious. An attempt was made to utilize them and analyze the blood of patients with chronic joint disease: (1) to determine any abnormality in the percentage of urea and non-coagulable nitrogen; and (2) to contrast these analyses made during disease with those made after the institution of treatment and convalescence. It was conceivable that though total analyses of ill patients might show no great departure from normal, comparisons made as just indicated might show relative variations of interest. 10 c.c. of blood were withdrawn from a series of cases, as noted, at about 8.30 A.M., before the patients had had breakfast, to avoid the disturbing influences of digestion. This blood was then promptly injected into acetone-free methyl alcohol and treated according to the technique recommended by Folin and Denis.[3]

---

[2] New Methods for a Determination of the Total and Non-protein Nitrogen, Urea, and Ammonia in the Blood, by Otto Folin and W. Denis, Jour. Biol. Chem., June, 1912, xi, No. 5.

[3] These analyses were made by Dr. C. B. Farr and Dr. J. H. Austin, who were conducting analogous observations in connection with nephritis and desired samples of normal and pathological blood as controls for their own series. They kindly included the writer's cases among their own careful observations. A duplication of the requisite apparatus and technique seemed unwise until some preliminary observations had indicated its justification, and the writer wishes to express his thanks and appreciation to Drs. Farr and Austin for this courtesy. The Non-protein Nitrogen of the Blood in Nephritis and Allied Conditions, by C. B. Farr and J. H. Austin, Jour. Med. Research, August 1, 1912, xviii, No. 2.

The figures yielded were as follows:

	Total non-coagulable nitrogen in mg. per 100 c.c. blood.			Urea in mg. per 100 c.c. blood.		
			Average.			Average.
Case VIII, patient ill	20.2	21.7	21.0	11.2	12.6	11.9
Case IX. Experiment 1. Patient ill.	27.8	25.7	26.0	14.7	14.5	14.6
Case XI, patient ill	22.6	22.7	22.65	9.3	10.2	9.6
Case IX. Experiment 2. Patient convalescent	27.0	26.4	26.7	12.8	..[4]	12.8
Case XIII, patient ill	24.6	25.5	25.0	12.0	14.2	13.1
Case XII, patient ill	24.4	25.0	24.7	10.4	..[4]	10.4

The nitrogen of strictly normal cases averages from 20 to 30 mg. per 100 c.c. blood. The urea figures in strictly normal cases are usually about 50 to 60 per cent. of those for nitrogen, but in disease this percentage runs higher. The urea figures include the preformed NH_3 of the blood, and constitute the so-called ammonia-urea fraction. These results are remarkedly close together, and correspond to those found by Folin in perfectly healthy students. General hospital cases without nephritis show much greater variations, the total nitrogen frequently ranging up to 35 and occasionally to 40 or even more. Nephritis cases have been found usually to range above 40 and in some cases, as mentioned, to 180 mg. per 100 c.c. blood.

These figures apparently indicate that the limit of toleration to proteid in rheumatoid arthritis is not due to any "backing up" of nitrogenous matter in the blood. It will be noted that in Case IX there was no important difference between the analyses made during disease and those made during convalescence, both being well within normal limits. Further observations on this point are pending.

These observations are not without significance, as the methods used permit of an accuracy greater than has been previously attainable, and suggest that there is no important change in these blood elements during this disease. Any abnormality present, however, may be too subtle to admit of estimation, and may act by anaphylaxis or some other imponderable means. It is also conceivable that such an abnormality though present in the blood sufficiently to produce and perpetuate the disease may disappear from the blood after a night's fast.

These are more or less theoretical objections, but they should be examined.

The writer was interested to learn from the joint work of Folin, Denis, Fitz and Frothingham[5] that in experimental uranium nephritis of rabbits the phenol-sulphone-phthalein excretion agreed with the non-protein nitrogen retention in the blood in that when the former was low, the latter was high and *vice versa*. This corroborates the writer's observations, in which the elimination by the kidney was high and the retention of non-coagulable nitrogen in the blood was low, with the molecular concentration of the urine as shown by Δ also in accord.

---

[4] Duplicates bad.

[5] Fifth Annual Meeting of the American Society for the Advancement of Clinical Investigation, Washington, D. C., May 5, 1913.

Attempts were also made to test the carbohydrate tolerance of these patients in respect to the glycolytic function, and a series of them was fed 100 to 150 grams of glucose on empty stomachs at 8 A.M. The twenty-four hour urines of the respective periods were collected and analyzed for sugar, with negative results. It is plain that the lowered carbohydrate tolerance of these patients is of a nature different from that characteristic of diabetes.

Discussion. A consideration of the observations adduced in this series of cases permits of certain general conclusions and develops a number of points of interest.

In the first place there seems to be no reasonable doubt that the disease rheumatoid arthritis, for which a host of therapeutic measures but no successful therapy has been heretofore advanced except that directed toward a focus of infection, is in most cases amenable to treatment and can apparently be prevented. Apart from the bony changes resulting from long standing disease, and in the sense that the inflammatory process causative of them may be arrested, it seems justifiable to say that in many cases which have not responded to other treatment or to attempts to remove foci of infection the disease is curable. It should be borne in mind that the consequences of long-standing arthritis are so far-reaching that related functions often become perverted, and there may ensue a trail of complications which masks or prevents the best end-results, just as in advanced diabetes, severe or long-standing cases may eventually get beyond practicable metabolic control.

In this series of 17 cases, representing practically all varieties of the disease, none failed to improve and only 3 stopped short of a gratifying convalescence. In the light of later experience it is fair to conclude that in 2 of these cases (Case II and Case IV), which incidentally were well-advanced, the principles of treatment were not pushed far enough. It became later evident that each case was a law unto itself, with a definite metabolic limit of food tolerance which must be reached by reduction before complete results could be achieved. For clinical purposes at least the disease seems to belong in the category with gout and diabetes, in that on the one hand the proteids and on the other hand the carbohydrates can be tolerated and metabolized in certain amounts only. The analogy to gout is not quite complete, since it is the purins more especially which are at fault in the former disease, but it serves as an illustration.

The role of the fats is not quite so clear, though it seems from the experiments made in connection with Case VII and Case XII that they can be borne and successfully used to fatten those individuals whose reduction of food intake has caused much loss of weight. In any event, they are dietetically less important than the carbohydrates and proteids, but their real limit will be considered in later studies. Until further observation and wider experience develop the limitations and possibilities of the measures here outlined, each case must be carefully scrutinized and guarded. Radical changes in diet may be causative of harm unless intelligently watched, and the author urges that no case be treated heedlessly. The issue cannot be forced, and time is required for recovery under even the most favorable circumstances.

The general metabolic limit of tolerance above described may help to explain the greater frequency of the disease in women. Of 21 cases under observation by the writer only 5 were in men.

With the known greater demand which physical activity puts upon caloric intake it is conceivable that men should, as a class, be better able to metabolize a possible surfeit than would women, whose lives are as a whole more sedentary; this is only an hypothesis, however.

Comment should be made on the frequent sensation of well-being which some patients experienced when placed upon the above diets. This was noted in Cases I, V, VI, VII, XIV, XV, and XVIII (the last is not here reported).

The writer does not wish to be interpreted as asserting that rheumatoid arthritis is a purely metabolic disease, since this has not been proved. The weak link in the metabolic chain, if present, has not been found any more than it has in gout, or in some cases of diabetes, but for clinical purposes at least this conception is useful.

Among the interesting points developed in the present series in this connection is the relation of a focus of infection to the incidence and perpetuation of chronic joint disease.

Practically the only real development recently made in the therapeutics of this condition is in the recognition, removal, and vaccine treatment of such foci, steps which have restored many cases to health. Some careful clinicians believe that all cases are due to an infective focus, known or unknown.

If this be true, it places many instances of the disease in the class of those having a hidden and unrecognizable focus, since the examples are legion in which no infection can be found. Many of the present series who responded well to treatment had been searched for years in this connection without success. Therefore it follows either that there is a distinct type of the disease which is due to an error of metabolism or else that cases having a causative but hidden source of infection respond to dietary measures. This last seems unlikely, except in the sense below described.

The evidence here submitted, therefore, substantiates the views of many observers that in a large number of these sufferers the disease is due to an error of metabolism in the widest sense of the word.

In point of fact, as noted in their case histories, Case XI and Case XIII had obvious sources of infection, but notwithstanding this they responded well to dietary treatment.

A logical view of these conditions is that the metabolism in a broad sense is primarily at fault.

In certain of them there may be an unstable metabolic equilibrium which is upset by an intercurrent infection, and the disease thus induced just as a diabetic in relative health may be precipitated into coma and death by bronchitis or la grippe.

The writer makes no postulates on this score and strongly advocates the removal of infection when possible. The fact remains, however, that many cases incurable by attempts to find and remove infection may be returned to health by the above means.

A question which has long interested students of arthritis is the relations and nature of the two generally recognized types, atrophic and hypertrophic arthritis.

There are many clinical and pathological classifications of the disease, and most writers add to the above one or two more, but atrophy and hypertrophy of the joint structures, singly or together, characterize practically all cases of long standing.

In the preliminary *x*-ray studies of the cases here reported attention was given to this, and while the atrophic process generally predominated, it was practically always accompanied by hypertrophy in greater or less degree.

Inasmuch as both types responded well to the same treatment, it would seem that atrophic and hypertrophic arthritis have much in common etiologically, or are perhaps manifestations of the same process.

The writer has endeavored to formulate some rule or working hypothesis for reducing the food intake in treating these cases, based on the caloric tolerance per pound or kilo of body weight, but has as yet been unable to do so. In general, the recent cases, especially in young subjects, recover upon a larger intake than do those of long standing, so that but little modification may be required to obtain results. The duration of the disease, however, is not necessarily a criterion as to its severity or the difficulty of arresting it (compare Cases VII and Case VIII) but it is important to begin treatment early to obviate the deformities and incidental evils which otherwise result. The writer has found it useful to observe for upward of a week the normal food intake of a given case, from which the caloric level can be approximated. From this as a basis the new diet can be constructed. It is obvious that in a mild case accustomed to a high metabolic level the food intake need not be reduced to the point necessary where the reverse is true; at least not until trial has shown this to be necessary.

Those cases presenting some soft tissue swelling as well as joint involvement are generally easier of treatment because progress can be observed in the subsidence of tumefaction and the wrinkling of the skin as well as in freer joint motility; whereas those cases presenting chiefly erosions or overgrowth of the non-articular parts of the bones may present little objective evidences of improvement. The subjective evidence of the patient over a considerable period of time, together with the loss of tenderness and limitation in movement, affords the indices in these instances.

A point which requires emphasis is that of the associated tendinous contracture and apparent ankylosis. When the activity of the arthritis *per se* has largely subsided there may come a point when the case seems to "hang fire." This occurred several times in the author's series, and was the source of considerable worry until the independent nature of the trouble was appreciated. It is of course common knowledge that these cases present contractures such as may be seen after fractures, etc., but the extent to which these contractures may simulate the condition causing them is noteworthy. The patient rarely can differentiate the two, and only close study by the observer will reveal the facts.

The appropriate treatment of such contractures is of course orthopedic, and needs no mention here except to say that, practically speaking, this has been almost as hard a question to meet, as the alleviation of the causative arthritis itself.

The long-standing habit of sparing tender joints and the reluctance to move make these convalescent patients unaware at times, of their own potential.

If to this state be added muscular atrophy, from disuse, leaving muscular tissue insufficient to move the part, the patient's quandary can be appreciated. At this point, and indeed at any stage of the disease, the time-honored adjuvants of baking, local rest, aspirin, etc., can be occasionally used, with benefit, provided they do not mask the real progress of the case through misleading temporary effects and so suggest false conclusions.

Some of the experiences here cited indicate that there may be a greater return of function in advanced cases and in apparently ankylosed joints than would seem *a priori* possible, as Case VIII and Case XI illustrate. Certainly the ulnar deviation so characteristic of these sufferers yields markedly, as shown in Case VIII, Case XII, and others. A point to be observed is that the inflammatory exudate around inflamed joints causes a fog in the x-ray picture which lessens and eventually disappears during convalescence. Unfortunately this does not lend itself well to reproduction in print.

Of the various joints susceptible to involvement, it may be said that the smaller ones, like the fingers, yield before the larger, such as the knees, which are among the last to subside and to acquire freedom of capsular and tendonous movement.

The spine seems also to be quite obdurate when much involved, though the earlier stages, as in Case VIII and Case XIII, where spondylitis was present, clear up entirely.

It should be noted that pain is a feature which may persist until convalescence has been well established, and may shift from point to point even though the process as a whole be subsiding.

In watching the clinical course of these cases and certain others, there has seemed at times to occur an associated neuritis. Because of this and other observations the writer suspects that some of the neuritides belong to this general category and can be alleviated by the same methods. This is not as yet proved, but the hypothesis is worthy of being tested in suitable cases of sciatica, circumflex neuritis, and the like. Case VI illustrated this point, as she had neuritic pains in her arms. To what extent this is true of the ocular manifestations of so-called chronic rheumatism cannot yet be stated, though here again some evidence at hand is suggestive, and a trial should be made.

The relation of acute inflammatory rheumatism to the condition here discussed is interesting and undetermined. The present conception of acute rheumatism is that it is an infectious disease. Whether any other variety exists is not known, but some of the present series manifested phenomena suggestively close, clinically, to the acute form, and the writer has observed at least one case apparently of this type in which the present methods were productive of unusual results. The evidence now at hand seems insufficient for more than hypothesis, but there is at least ground for suspicion that the relation of acute inflammatory rheumatism to chronic rheumatoid arthritis may be in some cases closer than has been thought. This is being made the subject of further investigation.

Much has been written as to the etiological relation of the large bowel to this condition, and in the above cases some attention was directed to it.

Of 17 cases x-rayed the large bowel was elongated, tortuous, and sometimes ptosed in 14. The remaining 3 showed practically a normal position of the large bowel, but, of them, 2 were very constipated. The disease may therefore occur in persons in whom no anatomical abnormality of the large bowel can be demonstrated by the x-ray, as in Case II, Case XV, Case XVIII, not here included, and possibly Case XI.

Constipation seems to be a frequent though in no sense a necessary feature.

The complete role, if any, which the colon plays is not yet elucidated, though it is clear, as pointed out earlier, that proteid putrefaction within the colon is not a factor. Colonic lavage, active purgation, sour milk dietary and other measures directed to this end, are therefore superfluous, except in so far as the general health may be benefited in other connections. Whether there may be absorbed from the colon noxious products of the break-down of both carbohydrates and proteids cannot be stated, but in any event the process is not that above discussed. The evidence to date is not in favor of the view that the disease is caused in or by the large bowel.

Attention should be called to the low number of calories upon which some of the reported cases subsisted and improved.

Case XI, Case XII, and Case XIV, after an initial fall of weight, nearly maintained an equilibrium upon about 1100 calories, a figure which is somewhat at variance with most clinical teaching as to the low limit permissible.

Sondén and Tiegerstedt, for example,[6] quote for the minimum figure for metabolism during sleep and as complete rest as possible, 24 to 25 calories per kilo, and in Case XI, here cited, they were about 20.

The above patients suffered no harm during these periods and eventually recovered, but while on the low diets were of course kept in bed. It is obvious that when it becomes necessary greatly to reduce the caloric intake of a severe case the energy output must be reduced as nearly proportionately as possible, to avoid tissue loss. The question of the calorimetry in this connection, however, is a chapter by itself, and may be made the subject of a later contribution. It should be noted that the disease began with all of these patients when they were on full diet and that during this large intake many of them developed the secondary anemia so common to this condition.

The writer is fortunate in that most of the cases cited here have been referred by other physicians, as noted in the text, who were familiar with the previous conditions of the patients or had actually treated them. Their independent observations often served as a useful control of the writer's deductions, and he owes an expression of appreciation for their interest and courtesy.

CONCLUSIONS. 1. Rheumatoid arthritis is apparently a preventable disease.

2. In most instances, except where the general health is undermined by great deformities and sequelæ of long-standing, the disease can be arrested.

3. For clinical purposes at least it seems to belong in the category with diabetes and gout, in that there is in each case a limit of toleration for carbohydrates on the one hand and proteids on the other. The role of the fats is not yet entirely clear, but they may prove to be borne analogously to the carbohydrates and proteids.

---

[6] Hammarsten, Physiological Chemistry, 1911, 6th ed., p. 878.

4. After arrest of the arthritis the diet can generally be gradually increased until in some cases it differs but little from that of health.

5. Both hypertrophic and atrophic arthritis respond to these measures, and their common etiology seems probable.

6. The presence of an intercurrent or possibly causative infection is not necessarily a contraindication to treatment, and recovery may take place in spite of it, though such factors should be eliminated if possible. *The large group of cases in which a causal source of infection cannot be found or removed lends itself particularly to these measures.*

7. Care is necessary to determine the highest level of metabolic equilibrium at which the arthritis will subside, and at or near that point the patient should be maintained.

8. While the general health improves with the subsidence of the arthritis, and though the patients seem to acquire a toleration for a larger dietary, the general principles above described must be rigidly observed or relapse will occur.

9. The disease is apparently not due to faulty elimination through the bowels or kidneys.

10. It is clearly not due to "intestinal putrefaction" so called. There is no reason to exclude proteid in dietary treatment, except in the sense above described, and the ordinary carbohydrate foodstuffs are also clearly capable of causing the disease.

The writer is indebted for courtesies and assistance which it is difficult properly to acknowledge.

To Dr. Samuel McC. Hamill, whose generous and broad-minded support has greatly increased the opportunities for this work; to Dr. Charles W. Burr; to Dr. William E. Hughes for the use of beds in his wards and other kindnesses; to Dr. W. S. Newcomet for coöperation in the *x*-ray studies; to Dr. Richard M. Pearce for assistance and advice; to Dr. Francis O. Allen and Dr. J. E. Sweet for surgical help; to Dr. Damon B. Pfeiffer, director of the pathological laboratory, for cordial coöperation. Appreciation should also be expressed to the President and the Board of Managers of the hospital for meeting many of the writer's requests, and to Mr. G. B. Kirkbride, superintendent of the hospital, for his receptive and helpful attitude toward new problems.